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(12) # EUROPEAN PATENT APPLICATION

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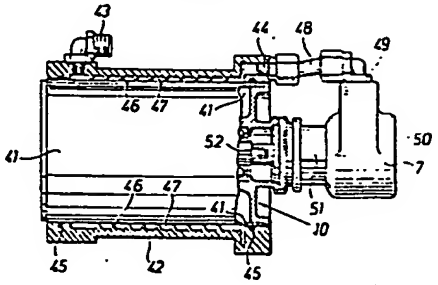
(54) A water-purification unit with a liquid cooled pump motor.

(57) A water-purification unit comprising a module (9) for reverse osmosis with an inlet (8) for non-purified water, an outlet (14) for purified water and an outlet (20) for non-purified water, the water being supplied to the module (9) by means of a motor-driven pump (7).

To improve the efficiency of the module the motor of the pump is cooled with the help of a water input which consequently is heated. At the same time the cooling system is made use of to achieve an effective sound insulation of the motor.

Fig.3



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TITLE

A WATER-PURIFICATION UNIT WITH LIQUID-COOLED PUMP MOTOR

TECHNICAL FIELD

The present invention relates to a water-purification unit comprising a module for reverse osmosis with an inlet for non-purified water, an outlet for purified water and an outlet for non-purified water, the water being supplied to the module by means of a motor-driven pump.

Such a module comprises diaphragms of optional shape, but of a composition designed to let through substantially only water molecules and molecules of the same order of magnitude. The diaphragms consist preferably of hollow fibres, but they may also take the form of e.g. plane films. If such a module contains pure water on the one side of a diaphragm and impure water on the opposite side, the so-called osmotic effect causes the pure water to endeavour to force its way across to the impure side to produce dilution and to even out the concentration. The concept of reverse osmosis here means that the pressure on the impure side is increased, so that the osmosis effect is offset and the water instead passes over from the impure side to the pure side.

BACKGROUND ART

The water-purification unit of the abovementioned type has the disadvantage among other things that the noise level is too high to allow individual small units to be placed for example in a sick-room together with equipment requiring absolutely pure water such as apparatuses for haemodialysis, peritoneal dialysis or haemofiltration.

DISCLOSURE OF INVENTION

The abovementioned problem is solved in accordance

with the invention in that the motor of the pump is cooled with the help of the water input, the latter being heated at the same time. In this way the efficiency of the module is simultaneously increased through the heating of the water.

The motor is preferably wholly surrounded by cooling water in such a manner that an effective sound insulation is obtained.

The motor may be enclosed, for example, in a water-tight cylindrical casing which in turn is enclosed in a water-tight outer jacket with inlet and outlet for the water. This outer jacket may be manufactured in one piece, preferably by injection moulding.

It is appropriate to produce the outer jacket in the form of a plane film which can be wound tightly around the water-tight casing of the motor. By providing the outer jacket on its inside and/or the casing on its outside with means in the form of ridges, flanges, etc, the path of flow of the water can be lengthened.

By combining the design in accordance with the invention, moreover, with a constant-flow valve, further substantial advantages can be obtained which are evident from the patent application..... submitted at the same time, entitled "A water-purification unit with constant-flow valve".

BRIEF DESCRIPTION OF DRAWINGS

In the following the invention will be described in greater detail with reference to the enclosed drawings, which show by way of example a preferred embodiment of the same.

Fig.1 shows a block diagram for the unit as a whole.

Fig.2 shows a constant-flow valve included in the unit.

Fig.3 shows the liquid-cooled pump motor included ih the unit.

Figures 4-7 finally show examples of a cooling jacket which can replace the cooling jacket shown in fig.3.

Fig.5 here shows a section along line V-V in fig.4 and similarly figures 6 and 7 show sections along lines VI-VI and VII-VII respectively in fig.4.

BEST MODE OF CARRYING OUT THE INVENTION

In the block diagram of a preferred embodiment of the subject of the invention shown in fig.1 a water inlet is designated 1. From the water inlet the water flows through an inlet valve 2 shown schematically, which for example may be a conventional solenoid valve. At a point 3 the pressure of the water is measured by means of a pressure gauge 4. From the point 3 the water is conducted further via a branch point 5, a conductivity meter 6 and a pump 7 to the inlet 8 of a module 9 for reverse osmosis. In the course of this, the water is heated by being used at the same time for the cooling of the pump motor 10. The module 9 is divided into a clean water side 11 and an input side 12. These sides are separated by a diaphragm 13 indicated schematically. The cleaned water is conducted out via an outlet and monitored with the help of a conductivity meter 15. The purified water is passed via a valve 16 to a place of consumption, e.g. an apparatus for haemodialysis. From a branch point 17 the excess water is conducted through a return pipe 18 which contains a non-return valve 19.

From the side 12 of the module 9 non-purified water is conducted via an outlet 20a and the pipe 20 to a distributing point 21. By means of a constant-flow valve 22-23 connected to this point it is ensured that a small amount of liquid is conducted at all times from the module 9 through the pipe 20 and further to a drain 24.

Numerals 22-23 thus designate a constant-flow valve

which may be of the design as shown in fig.2. Lines 22a and 22b together with the spring 23a indicate that the valve is acted upon from one direction by the input pressure, whilst from the opposite direction it is acted upon partly by the secondary pressure and partly by a spring pressure. The liquid may also pass through a throttle 25. The part of the liquid in the pipe 20 which does not go through the constant flow valve is conducted instead through a pipe 26 and an adjustable valve 27, e.g. a needle valve, back to point 3 and further through point 5 to the inlet 8 of the module 9.

The module may nevertheless become silted up or obstructed in some other manner and therefore requires flushing through from time to time. For this purpose a special flushing valve 28 is arranged parallel with the constant-flow valve 22-23. When the valve 28 is opened, larger amounts of liquid can be flushed through the input side 12 of the module 9.

To make it possible to sterilize the system, it is provided with an intake 29 for sterilizing agent. This intake is provided with an optical system 30, shown schematically, which is capable of detecting whether or not the intake is connected to a source of sterilizing agent. If such a source is connected, only special sterilization programmes can be carried out, which means that there is no risk then of any patient coming into contact with the sterilizing agent. This sterilizing agent is thus conducted from the intake 29 via a non-return valve 31 and a shutoff valve 32 to the point 5 which should be located as near as possible to the inlet valve 2.

The constant-flow valve 22-23 may be of any type. However, in practice the valve 23a shown in fig.2 has proved to be suitable. This valve 23a is provided with an inlet side 33 and an outlet side 34. In between are a pressure chamber 35 and a spring 36. The pressure chamber 35 is

separated from the inlet side 33 by a piston 37 which has a throughhole 38 and is encircled by a sealing ring 39. The piston 37 is arranged so that it partially covers a duct 40 between the pressure chamber 35 and the outlet 34. When the pressure on the input side 33 is increased, the duct 40 is throttled, so that the pressure is automatically increased also in the pressure chamber 35. This in turn gives rise to a substantially constant flow through the ducts 38 and 40.

Whilst the valve described above has proved to be suitable, it will nevertheless be clear to those versed in the art, that other types of conventional constant-flow valves can also be used.

In fig.3 are shown the pump 7 referred to earlier and its liquid-cooled motor 10. The motor here is fully enclosed in a water-tight cylindrical casing 41, which in turn is enclosed in a water-tight outer jacket 42. This outer jacket 42 is provided with an inlet 43 and an outlet 44 for the water. The seal between the casing 41 and the outer jacket 42 is achieved with the help of two O-rings 45. By means of a spiral-shaped ridge 46 the water is forced to pass the motor 10 in a helical path 47. In this manner the path of flow of the water is substantially lengthened. From the outlet 44 the water flows through the pipe 48 to the inlet 49 of the pump 7. The pump outlet is not shown. It may be arranged either at the back of the pump or at its end face 50. The pump 7 and the motor 10 are connected to one another by the connection piece 51 and the mechanical driving clutch 52.

In figures 4-7 is shown an alternative to the outer jacket 42 shown in fig.3. Here a corresponding jacket 42a has been manufactured in the form of a plane film which can be tightly wound round the water-tight casing 41 of the motor. The sheet 42a is provided on its inside with ridges 46a which force the water to move in a zigzag-shaped course

47a from the inlet 43a to the outlet 44a. The groove 45a is intended to accept a packing corresponding to the O-rings 45 in the design according to fig.3. Finally, numeral 53 designates a framework of flanges which are intended to reinforce a trailing edge 54 which in an appropriate manner is joined to the other end 55 of the sheet when the sheet is wound round the motor 10.

Naturally, the invention is not limited exclusively to the embodiment described above, but can be varied within the scope of the following claims.

CLAIMS

1. A water-purification unit comprising a module (9) for reverse osmosis with an inlet (8) for non-purified water, an outlet (14) for purified water and an outlet (20a) for non-purified water, the water being supplied to the module (9) by means of a motor-driven pump (7), characterized in that the motor (10) of the pump is cooled with the help of the water input, the latter being heated at the same time.

2. A water-purification unit in accordance with claim 1, characterized in that the motor (10) is practically wholly surrounded by the cooling water in such a manner that an effective sound insulation is obtained.

3. A water-purification unit in accordance with claim 2, characterized in that the motor (10) is enclosed in a water-tight cylindrical casing (41) which in turn is enclosed in a water-tight outer jacket (42) with inlet and outlet (43 and 44 respectively) for the water.

4. A water-purification unit in accordance with claim 3, characterized in that the outer jacket (42a) is manufactured in one piece and preferably by injection moulding.

5. A water-purification unit in accordance with claim 4, characterized in that the outer jacket (42a) is made in the form of a plane film which is wound tightly round the water-tight casing (41) of the motor.

6. A water-purification unit in accordance with any one of claims 3-5, characterized in that the outer jacket (42a) on its inside and/or the casing (41) on its outside is provided with devices in the form of for example, ridges, flanges, etc. (46,46a) by means of which the path of flow of the water can be lengthened.

Fig.1

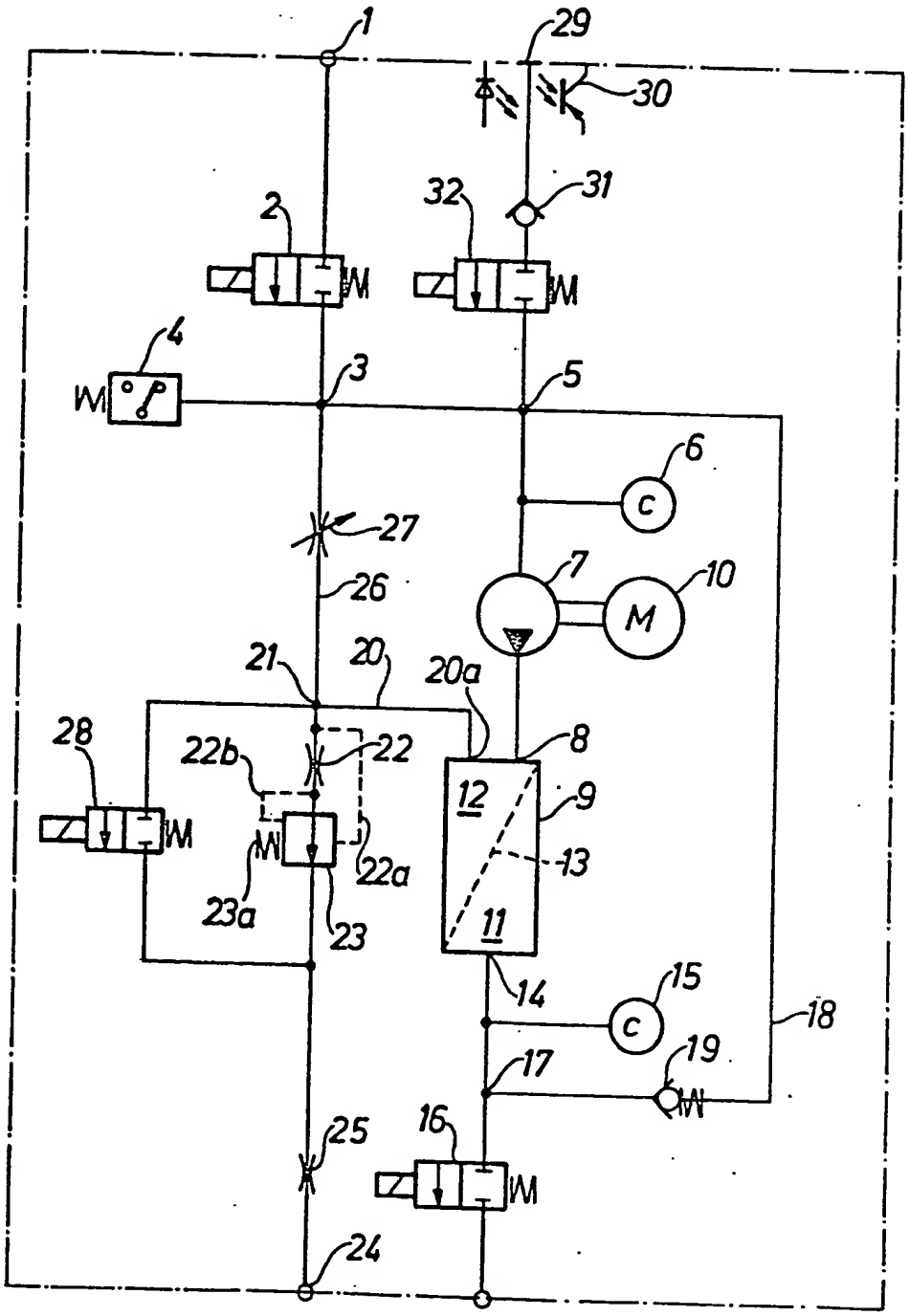
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Fig.2

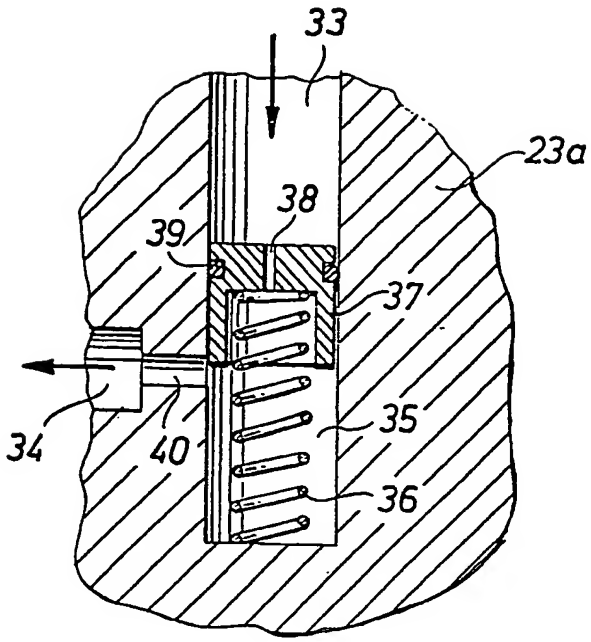
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Fig.3

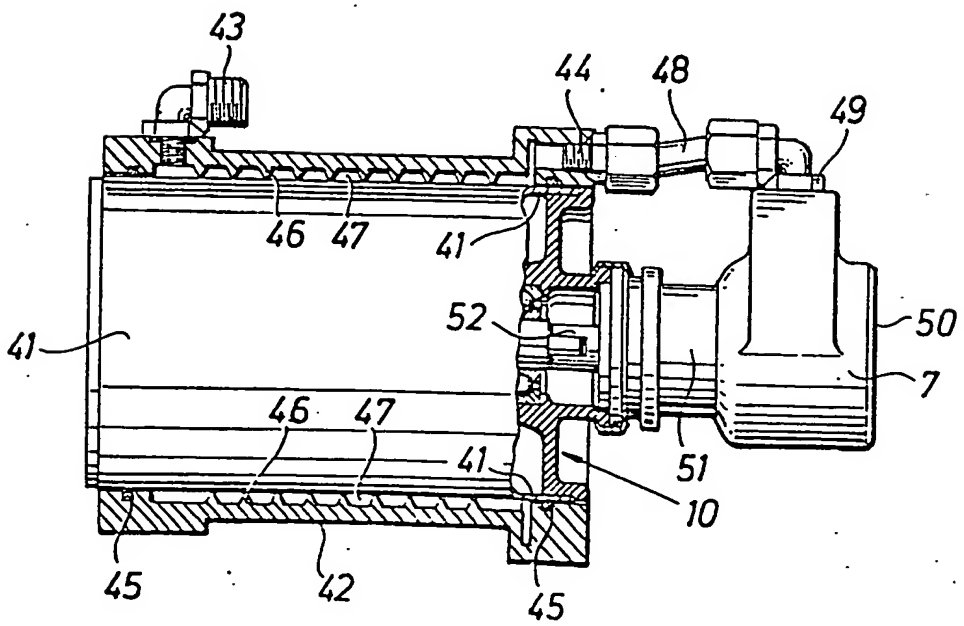
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Fig.4

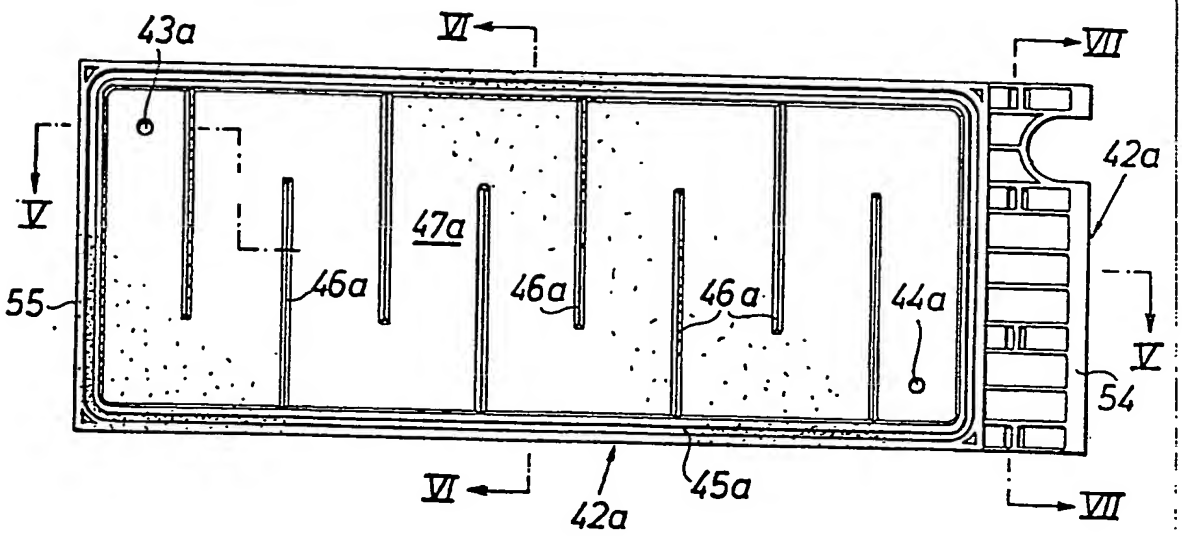


Fig.5

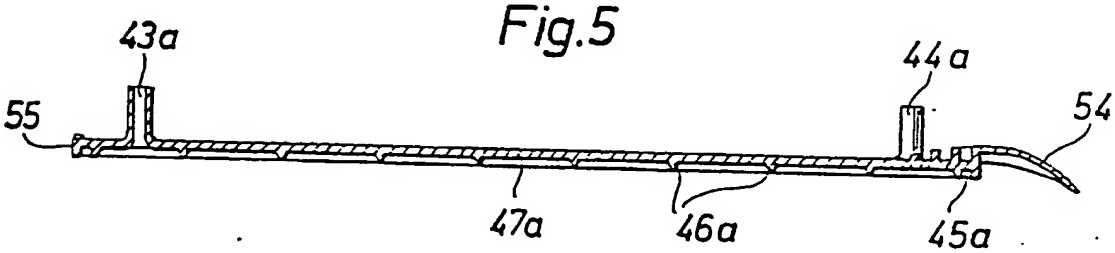


Fig.6

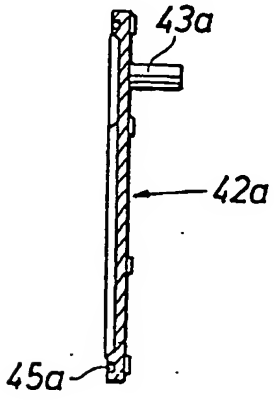
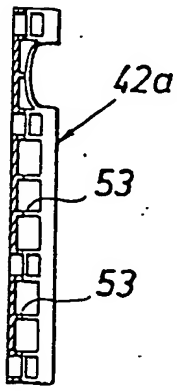


Fig.7



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EUROPEAN SEARCH REPORT

0058303

Application number

EP 82 10 0332

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	DE-A-2 301 904 (B.TERSTEEGEN) *Claims 1,2,4,5; figures; page 7, lines 16-25*	1,2	C 02 F 1/44 B 01 D 13/00 // A 61 M 1/03
A	GB-A-2 002 736 (E.ALHAUSER) *Claims 1,2,6,7; figures; page 1, lines 109-117; page 3, lines 91-98*	1	
A	US-A-2 763 214 (H.T.WHITE) *Complete document*	1,2,3, 4	
A	US-A-2 000 874 (C.L.BABB) *Complete document*	1,2,3, 4	
A	DE-C- 516 474 (SIEMENS-SCHUCKERTWERKE AG) *Page 1, lines 1-6; page 2, lines 15-21,29-33,90-96; figures 1-4*	1-4,6	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	US-A-3 371 613 (J.K.A.DAHLGREN) *Complete document*	1-4,6	B 01 D C 02 F A 61 M F 04 D
A	DE-A-2 804 653 (OLOFSSON B.O.E.) *Claim 1; page 5, lines 22-29; figures* & GB - A - 1 592 218	1,2	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02-06-1982	HOORNAERT P.G.R.J.

CATEGORY OF CITED DOCUMENTS

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